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ANIMAL DISEASE ERADICATION BRANCH
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Mucosal-Like Diseases

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Mucosal diseases is the name given a group of relatively new diseases of cattle in the United States. Because these diseases are similar in that they affect the animals' mucous membranes or tissues lining the digestive and/or respiratory systems, they are commonly referred to as mucosal diseases. Bacteria have been eliminated as the causative agent in practically all instances. Some of these diseases are caused by viruses (bacteria-free filtrates) whereas the causes of others have not yet been determined. When the disease affects the mucous membranes of the digestive tract, diarrhea is a common symptom, thus accounting for the nomenclature synonym "virus diarrhea." These diseases are important not only because of the economic losses they produce in our cattle industry but also because of their clinical resemblance to and the need for their differentiation from rinderpest, a highly fatal exotic virus disease presently indigenous to many parts of Asia and Africa but which has never yet appeared in the United States.

There are now recognized in the United States four or more different diseases of cattle which belong to the mucosal disease group, identified as (1) New York virus diarrhea, (2) Indiana virus diarrhea, (3) Iowa mucosal disease, and (4) California influenza-like disease. These diseases are similar to and probably should be grouped with (5) malignant catarrhal fever and (6) bluetongue of cattle, both of which have been recognized as exotic diseases but probably now exist in this country. In addition, it is possible some of these diseases may play a part in the syndrome of shipping fever, described elsewhere in this Yearbook.

The first of the mucosal diseases was recognized and identified as New York virus diarrhea in 1946 by Peter Olafson, A. C. MacCallum, and F. H. Fox. However, one or more of these diseases may have been present in the country as early as 1920 according to reports in the March 1920 issue of the American Veterinary Medical Association Journal.

New York virus diarrhea of cattle was the first mucosal disease in the United States identified in 1946 as to virus origin and later differentiated from rinderpest by R. V. L. Walker and Peter Olafson. It is an infectious, febrile, transmissible disease characterized by profuse diarrhea, ulcers, and erosions of the digestive tract. The incubation period is from 7 to 9 days following which there is usually a sudden rise in temperature, lack of appetite, depression, a drop in the white blood cell count, diarrhea,

sometimes coughing, ulcers, and erosions of mucous membranes; and pregnant cows may abort in from 10 to 90 days following the onset of the acute disease. Young animals appear to react more severely to the disease and may be more susceptible than older animals. Animals which have recovered from the disease are immune to reinfection. The animal morbidity incidence may vary considerably. The disease incidence in early outbreaks was 33 to 88 percent, probably depending on the strain of virus and individual resistance or partial immunity from previous exposure to the virus. Early disease outbreaks in New York State showed a much higher morbidity incidence than was reported in later years. The death rate in early outbreaks averaged 4 to 8 percent of the affected animals; however, in later years, even though only a few animals showed clinical evidence of infection, about 50 percent of these cases died.

The geographic distribution and extent of the disease are probably much greater than is generally supposed because it has been found that numerous animals from almost all sections of New York State, exposed with challenge virus, were resistant to infection. Virus has been isolated from animals in New York, Connecticut, and Maine by J. A. Baker, C. J. York, J. H. Gillespie, and G. B. Mitchell; and in California by J. D. Wheat, D. G. McKercher, and C. J. York. Shortly after the appearance of the disease in New York, a similar disease was reported in Canada during 1946 by T. Childs; and in Sweden during 1951 by H. Hedstrom and I. Isaksson. Immunological comparisons of the United States virus strains indicate they are of the same immunological type. There have been no comparisons made between the New York virus and the Canadian and Swedish viruses.

Serological identification tests, including complement fixation and serum neutralization tests, have not been successful. A limited number of experimental inoculations into other animal species, including fertile chicken eggs, guinea pigs, swine, dogs, cats, goats, sheep, mice, and rabbits were successful only in rabbits. Virus transferred through 75 passages in rabbits became modified in virulence for cattle so it could be considered for vaccine immunization.

Indiana virus diarrhea, a mucosal disease of cattle similar in clinical appearance to New York virus diarrhea, appeared in Indiana during 1954 and was studied at Purdue University by W. R. Pritchard, Doris B. Taylor, H. W. Moses, and L. P. Doyle. The natural disease has been observed only in steers. The disease was transmitted to calves of both sexes with bacteria-free virus filtrates prepared from blood of diseased animals. The incubation periods were one to three weeks followed by a sudden rise in temperature, loss of appetite, depression, increased heart action, and rapid respirations. These symptoms were followed by nasal discharges, coughing, lameness, and diarrhea associated with the development of muzzle, mouth and intestinal lesions characterized by circular areas of inflammation and erosions of the mucous membranes. Similar lesions were observed in the nares and in the vulva and vagina of inoculated cattle.

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The morbidity incidence was almost 100 percent, the mortality rate 4 to 20 percent, and the disease course 2 to 4 weeks in most instances.

This virus disease, while appearing clinically hematologically, and pathologically almost indistinguishable from New York mucosal disease virus diarrhea, immunologically appears to be a different disease. Recovered animals from the Indiana virus disease were immune to challenge with the Indiana virus but were susceptible to exposure with the New York virus, whereas recovered animals from the New York virus were susceptible to challenge with the Indiana virus.

Attempts to transmit the Indiana virus to sheep, guinea pigs, mice, and fertile chicken eggs have been unsuccessful.

Iowa mucosal disease of cattle was first observed by F. K. Ramsey and W. H. Chivers in January 1951 in a 10-months-old Hereford steer admitted to the veterinary clinic at Iowa State College. By 1953 it had appeared on approximately 100 Iowa farms, scattered throughout the State, and on several farms of some adjoining States. The disease has continued to spread in an alarming manner so that by 1955 it was estimated to have appeared on between 200 and 400 Iowa farms. Reports from a national survey study showed the disease had spread to all the States around Iowa as well as other States from the Atlantic to the Pacific Coasts. Eighteen States and one territory reported they have this disease, namely: Colorado, Illinois, Indiana, Iowa, Kansas, Maryland, Michigan, Minnesota, Missouri, Montana, Nebraska, North Dakota, Ohio, Oregon, South Dakota, Virginia, Washington, Wisconsin, and the Territory of Hawaii. Four States - Arizona, Idaho, New Mexico, and Oklahoma reported they were not certain if they have the disease. Nineteen States reported they do not have the disease, namely: Alabama, Arkansas, California, Delaware, Florida, Georgia, Louisiana, Maine, Mississippi, Nevada, New Hampshire, New York, Pennsylvania, Rhode Island, Tennessee, Texas, Utah, Vermont, and Wyoming. The following seven States failed to make a report: Connecticut, Kentucky, Massachusetts, New Jersey, North Carolina, South Carolina, and West Virginia.

The Iowa mucosal disease presents a clinical and pathological picture similar to the New York virus diarrhea and Indiana virus diarrhea but differs from them in that the herd incidence rate is usually low, probably averaging between 2 and 5 percent. The mortality rate in clinical cases is practically 100 percent as almost all of the affected animals die. Experimental transmissions of the disease have been unsuccessful, the cause of the disease remains unknown, and no satisfactory treatment has been developed. Early cases of the disease usually have an elevation of body temperature for 24 to 48 hours after which it returns to normal. There are complete loss of appetite, watery diarrhea sometimes mixed with blood, drooling of saliva, depression, rapid loss of weight accompanied

by the development of erosions, and ulcers of the mucous membranes of the nostrils, muzzle, lips, gums, tongue, and mouth cavity. Some animals have a discharge of tears from the eye, opacity of the cornea, and some develop lameness. The course of the disease is from 3 to 10 days followed by death.

It is quite likely that many animals in affected herds have developed an inapparent or nonclinical form of the disease because there have been no records of recurrence of the disease on the same farm, indicating that a herd immunity developed. Also, some attempts at transmission from affected animals to normal calves resulted in incubation periods from 2 to 8 days following inoculation which was followed by temperature reactions lasting 2 to 5 days without development of any other evidence of clinical disease.

All of the common beef and dairy breeds have been affected. Most of the animals affected have been 6 to 14 months of age. There has been no seasonal factor associated with disease occurrence although Iowa reported the seasonal incidence was greatest during the winter and early spring. The occurrence of affected herds 10 to 20 miles or more apart, along with the evidence of no transmission by contact, suggests insect vector transmission. However, seasonal disease occurrences are usually associated with such insect vector transmitted diseases.

California influenza-like disease of cattle (Colorado necrotic rhinitis and tracheitis in cattle). A highly contagious, acute, influenza-like disease of cattle, involving principally the mucous membrane of the upper respiratory tract, occurred in the dairy cattle of Los Angeles and surrounding counties of California from October 1953 to February 1954, reported by D. G. McKercher, J. E. Moulton, and D. E. Jasper and by R. J. Schroeder and M. D. Moys. A single outbreak which lasted six weeks occurred in dairy cattle in the Stockton area as the disease was subsiding in the Los Angeles area. The following year, starting in September 1954, the disease appeared again in the Stockton area in feeder cattle. Almost simultaneously it appeared in feeder herds in the Imperial Valley and later reoccurred in dairy cattle in the Los Angeles area. These outbreaks lasted from 2 to 3 months.

An analytical study of about 10,000 animals involved in these outbreaks showed the morbidity rate to be about 22 percent and the mortality rate between 2 and 3 percent, or 12 percent of the affected animals.

The State of Colorado reported a large outbreak, during January and February 1955, of a disease condition in feeder cattle similar to the California influenza-like disease. This outbreak involved 250,000 cattle throughout the northeast quarter of Colorado. An average of 50 percent of the animals in affected herds became sick, with about one percent mortality or 10 percent mortality of clinical cases.

This disease has been recognized on a less extensive scale in Colorado feet lot cattle since 1950. The incidence of infection appeared to decrease in succeeding years except in areas or herds where the disease was new.

In California dairy cattle the disease first caused an abrupt cessation of milk flow, and high temperatures with little evidence of other symptoms. Temperature elevations continued 3 or 4 days before returning to normal. During the second and third days of sickness there was some drooling of saliva, slight nasal discharges, slight depression, increased respiration, and occasional coughing. Some animals showed impaired appetites. There was no change in white blood cell counts and most of the cows returned to the milking string after 7 to 10 days. Dairy type calves showed similar symptoms without any evidence of depression and, in addition, showed a conjunctivitis with a marked discharge of tears not involving the cornea.

In beef or feeder cattle the disease usually appeared 3 to 6 weeks after the animals had been placed on feed. Early cases showed high temperatures which usually returned to normal after a few days. Temperature reactions are associated with depression, increased respirations, a marked inflammation of the upper respiratory tract including the nares, pharynx, larynx, and trachea with various degrees of nasal mucous discharges, drooling of saliva, and some eye involvement. After a few days some animals showed lameness, diarrhea, and weight loss. There is usually little or no lung involvement, little or no change in white blood cell counts, no central nervous symptoms, and no visible mouth or tongue lesions.

Even though the disease is naturally highly contagious, most transmission trials have failed to produce an agent which will reproduce clinical cases on successive animal passages, according to R. W. McIntyre. Frequently, only slight temperature elevations are observed in inoculated animals. Many experimental laboratory animals, including guinea pigs, mice, and fertile chicken eggs, were inoculated without evidence of disease transmission. There is evidence of a good immunity following recovery of infected herds as recurrences of known infection have been rare. The economic losses produced by the disease are largely due to weight loss, milk loss, and cost of animal treatment.

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